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Imaging $^{192/193\text{m}}\text{Ir}$ Sources Using Digital Autoradiography for Nuclear Forensic Applications

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Summer Fun



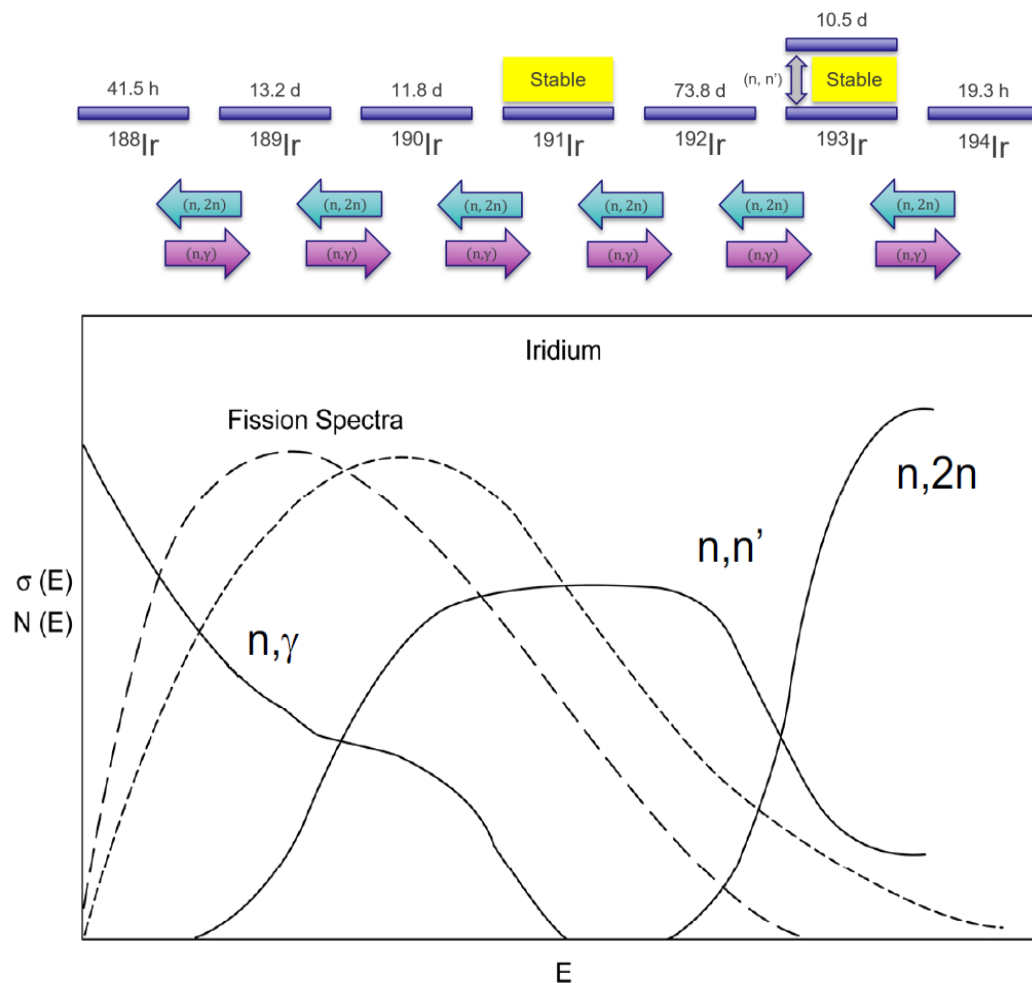
Jenna Garcia (C-NR)

- Education
 - B.S Chemistry; Old Dominion University, 2019
 - PhD candidate in chemistry, Texas A&M
- Chemistry Division
 - Nuclear and Radiochemistry
 - Nuclear Chemistry team
 - Evelyn Bond
- Research
 - LANL: Imaging radioactive sources using autoradiography
 - Texas A&M: Nuclear forensic analysis of a radium pigment sample



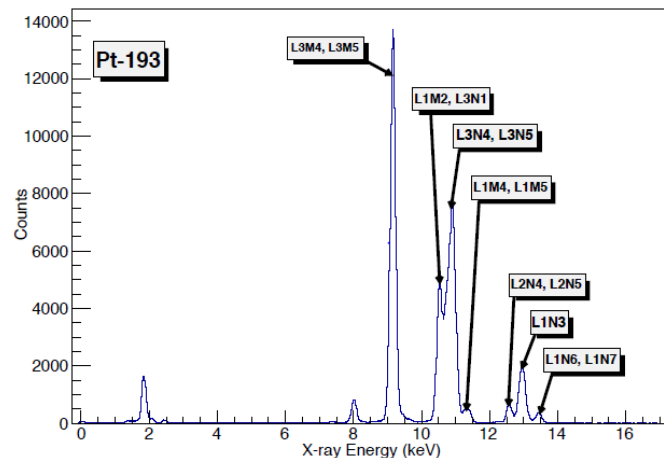
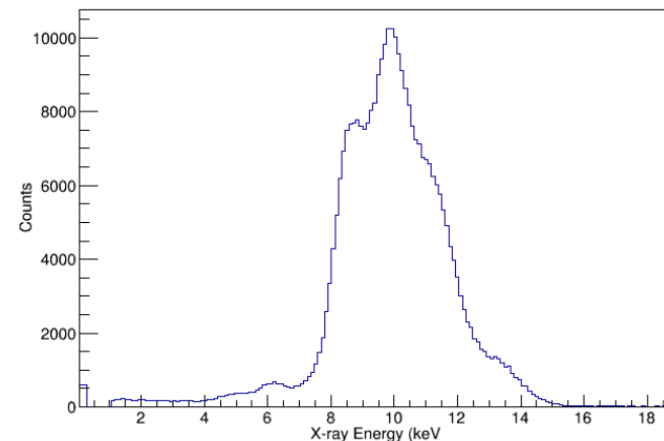
Project Motivation

- Iridium is used as a neutron fluence monitor.
- Irradiation of natural iridium produces radioactive isotopes ^{193m}Ir and ^{192}Ir that are important to stockpile stewardship.
- Isotope ratios of iridium may be relevant towards post-detonation nuclear forensics.



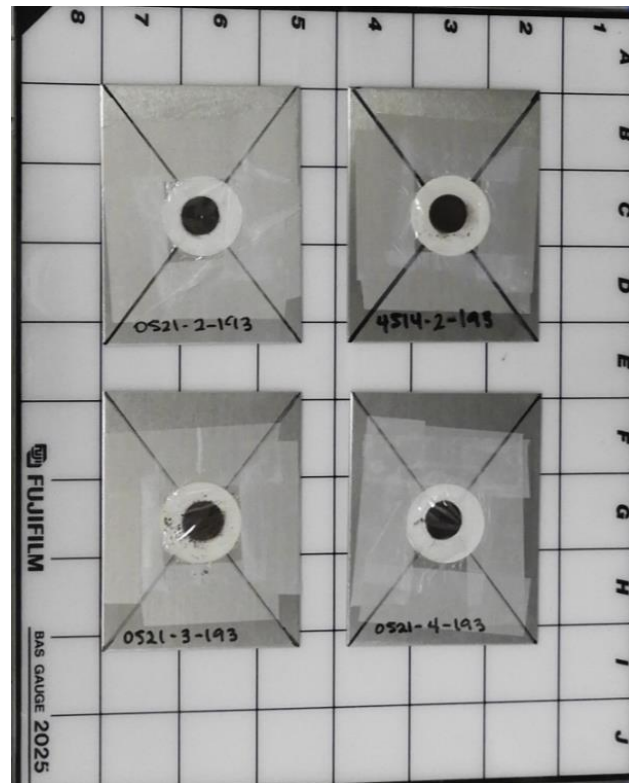
Project Motivation Continued

- ^{193m}Ir can be assayed via its x-rays; however, their abundance is very low and they can be self-attenuated even in thin deposits.
- ^{193m}Ir L x-rays (9 and 10 keV) are also difficult to be resolved from Os and Pt x-rays using traditional gas proportional counters.
- Silicon Drift Detectors (SDDs) have enhanced resolutions of about 0.15% and have the ability to resolve these x-rays.



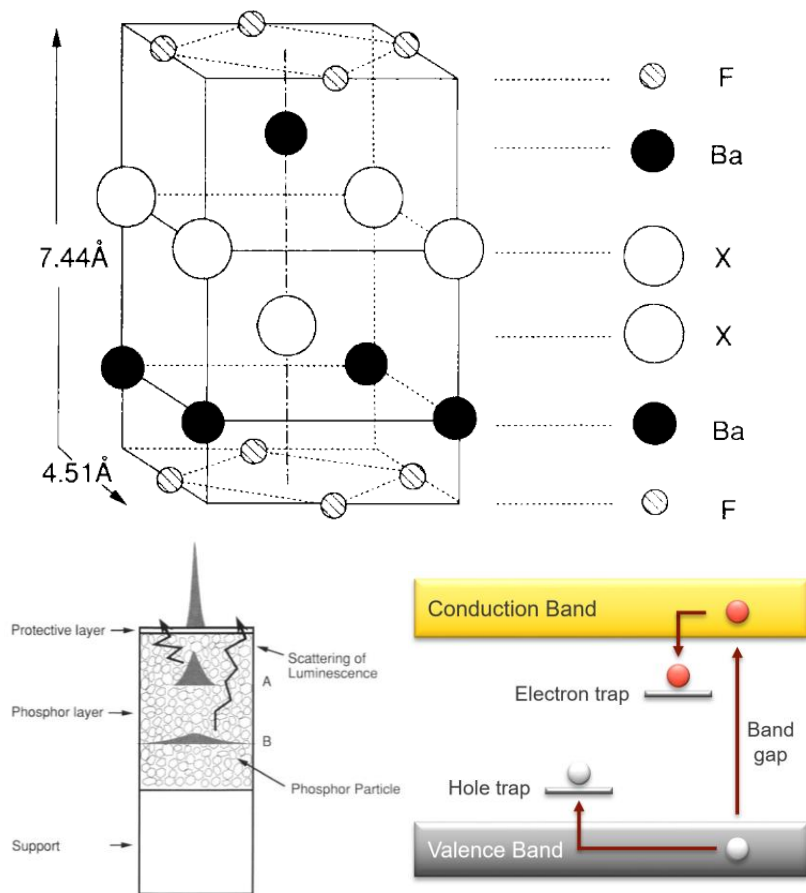
Imaging radio-iridium Samples Using Autoradiography

- This work aims to develop a new methodology for assaying $^{192/193\text{m}}\text{Ir}$ -containing materials.
- SDDs cannot determine activity spatially, thus it is important that the prepared samples are uniformly distributed.
- Autoradiography is used to image radioactive samples using imaging media by direct exposure.
- Using this technique, radio-iridium samples will be imaged to determine uniformity and self-attenuation as a function of mass.



Phosphor Imaging Film: (BaFBr:Eu²⁺)

- The phosphor layer of the film is made of BaFBr:Eu²⁺.
- Radiation oxidizes Eu²⁺ to Eu³⁺ and the ejected electron is trapped in Br⁻/F⁻ centers.
- Low energy laser within instrument scans the exposed film to release trapped electrons.
- PMT collects light as electrons return to their original state and the image is captured.



Summary of Results

